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VOL. LXXVI No. 1955

29 December 1956

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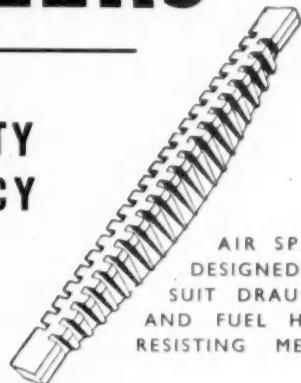
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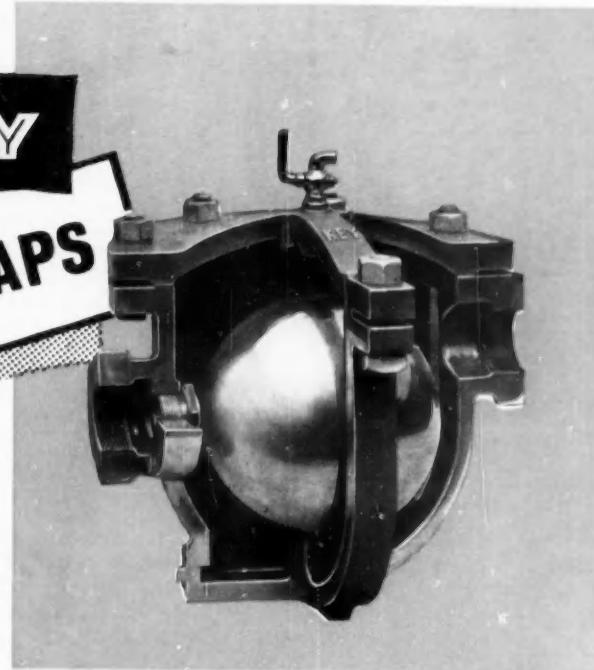
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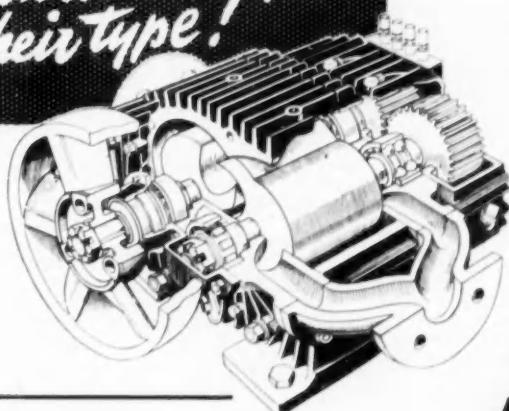
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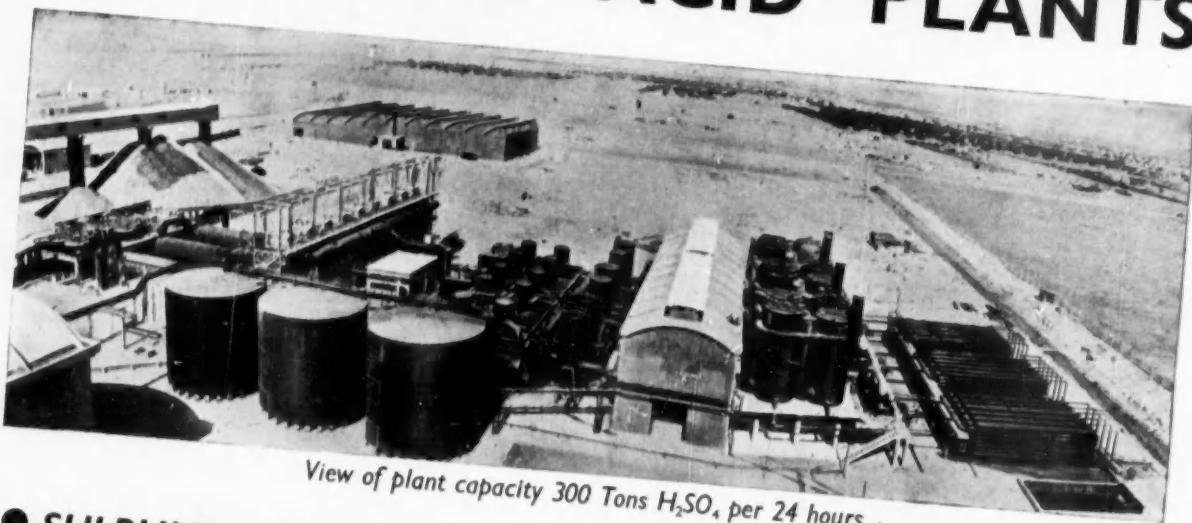
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VIEWPOINT

Health & Safety

AT A SEASON when most people are wishing most other people the best of health, the publication of the Ministry of Health's annual report seems almost excessively topical. Still, to take this theme literally even at New Year should not be regarded as boring. Good health and the conditions that maintain it are not thought or talked about enough; collectively as a people we are defensively naïve about diseases that threaten life and its enjoyment, and it is not happy-go-lucky courage but ignorance and fear that drive these topics out of sensible conversation.

The first part of the Ministry's report was in fact issued several weeks ago—this dealt largely with the *modus operandi* of national health services etc. It is the second part—the Chief Medical Officer's report on the state of our health—which arrived with the holly.

Part II of the report has a historical background, for it covers the 100th year since the first appointment of a Medical Officer for the then-named General Board of Health. When the state of pollution of civic environments of those days is compared with their much-criticised state of pollution today, this subject is seen in the perspective of progress. Then most of the water drunk in London and other large towns was polluted, and the air breathed was no better. In 1955 it is possible to discuss an unusual case of public water supply infestation by the crustacean wood louse, and its complete eradication by 1/2,000th of a part per million of pyrethrin. In the 19th century such a case would never have been detected in the welter of much grosser pollutions.

There can be no complacent pride of progress, however, about air pollution. Part II reports that Midland and North-West fogs in November produced pollution effects similar to those of London's disastrous December in 1952, and though the duration of these fogs was shorter, the same rising trend in deaths occurred, notably 50 additional deaths from bronchial ailments in Manchester. The chronic as well as the acute effects of dirty air give due cause for apprehension.

Every year valuable production time is wasted in industry through accidents. In 1955, almost 20 million man days were lost. Marked improvement in working

conditions such as general cleanliness, good lighting, heating, ventilation and even cheerful colour schemes by enlightened managements, has done much to keep employees happy and contented and ensured satisfactory production volumes.

It has become increasingly evident in recent years, that existing arrangements for safety and health in industry are inadequate and, for the first time since 1928, a survey and reorganisation is being undertaken. Representatives of employees and workers are meeting at national level to deal with industrial health and safety by the setting up of the Industrial Health Advisory Committee and the Industrial Safety Committee. The Health Committee is representative of both sides of industry, and of the BMA, the Royal College of Nursing and other professional bodies.

Duties of the Industrial Safety Committee are to make industry more aware of the dangers of neglecting health and safety by providing information and statistics about these questions, together with advice and information on the best ways of tackling them.

The Industrial Health Advisory Committee's advice to conduct two surveys on general health in industry—one to review conditions affecting health in a single locality (Halifax) and the other in a single industry (pottery) is noteworthy in the field of research on general health in industry. The Halifax inquiry dealt with an assessment of the standards of environmental conditions, and the layout and efficiency of plant and machinery, a description of health hazards in various processes, with a note of the adequacy of preventive measures against them as well as a survey of medical supervisory arrangements.

Formation of these bodies should relieve the factory inspectorate of much of the advisory work which it now does and enable more factory visits to be made by inspectors. These are essential to ensure that the Factory Acts are not neglected.

Undoubtedly the most effective way of dealing with the problems of industrial safety and health is voluntary action by industry itself. Hence the Government's aim in encouraging employers and trade unions to investigate and tackle these matters.

NORTHERN IRELAND CEREMONY

Governor Lord Wakehurst Opens Acrilan Plant Site

A CEREMONY marking the opening of the site of the £3½ million Acrilan chemical plant to be built at Coleraine, near Londonderry, Northern Ireland, was performed on 21 December by the Governor, Lord Wakehurst.

The company manufacturing Acrilan synthetic textile fibre, Chemstrand Ltd., awarded the contract for the complete design and construction work on the plant to Costain-John Brown Ltd. of London (see THE CHEMICAL AGE, 13 October, p. 62).

The plant will be completed by the beginning of 1959 and is designed to produce 10 million lb. of Acrilan fibre each year during the first stage of operation.

All divisions of Costain-John Brown—engineering, construction and plant—are employed on this contract, the engineering division consisting of chemical, civil, instrumentation and electrical engineering and drawing office sections.

Construction on the site began on 10 December—only seven weeks after a start had been made on all phases

of design on this project. The design work which began on 21 October and includes civil, mechanical, chemical, and instrumentation engineering is running according to schedule and the project is fully staffed.

The Acrilan plant project is an example of the turnkey system of contracting used by Costain-John Brown. Under this system the company undertakes a contract in its entirety. Major sub-contracting is avoided and control and supervision is unified, with responsibility vested in only one company. In other words, a client can state in general terms what product he wishes to make and in what quantity and the contracting company hands over a plant turning out the stated requirements.

The Chemstrand plant at Coleraine is to include many modifications and improvements gained in operating a factory in the US and existing plant and processes had to be related to British standards and the materials and equipment available in the United Kingdom.

INDUSTRIAL LUBRICANTS

HEAT-RESISTING, water-repellent, non-melting industrial lubricants based on special Bentone greases, a modified bentonite clay being used as thickening agent instead of a metallic soap containing molybdenum disulphide, are now being produced by Rocol Ltd., in the UK, the Commonwealth, Europe and Latin America. They are Molytone Grease, Molytone LM, Molytone X and Molytone C.

Molytone grease is a combination of a Bentone grease and molybdenum disulphide, with a temperature-resistance which enables machinery to be operated continuously at as high a temperature as 450° F (50° F higher than formerly possible). Pressure resistance gives positive lubrication at 100,000 lb. per sq. in. working pressure countering wear, sticking, or seizure. Starved conditions of lubrication can be tolerated without damage to bearings.

There is no melting point and the grease can be used in conditions up to the point of inflammability of the basic oil. Due to its water-repellent property Molytone grease has been found of value in high pressure steam atmospheres and other wet conditions since its lubricating properties are unimpaired, and in bottling plants. Absence of 'bleeding' eliminates any danger of contamination of products

in the food processing, canning and other industries.

Molytone grease is of the soft consistency of normal ball and roller-bearing grease and can be used in existing grease cups and grease guns.

Containing a higher molybdenum disulphide content than Molytone grease, Molytone LM is designed for the lubrication of gas cocks, plugs and valves, particularly where much heat is experienced. It has, also, many applications as an anti-seize grease, particularly where sealing at high temperatures is required. It can be used for the prevention of freezing and fretting of static parts fitted together or under semi-static conditions.

A rubber lubricant is Molytone X, a combination of molybdenum disulphide and a non-petroleum Bentone grease. Unlike previous rubber lubricants, it is soft and can be applied by ordinary lubricating equipment. Rubber parts are neither harmed nor softened by it. Solvent-resistance of Molytone X is stated to be particularly good against petroleum solvents. It is also water-repellent.

A special modification of Molytone X grease is Molytone C grease. It is a combination of molybdenum disulphide and a soft Bentone non-petroleum grease and is a softer grease for use in car brake servos.

Construction Company

Electric Bond Buys Cyanamid Products

THE FORMER engineering division of American-owned Cyanamid Products of London has been acquired by Electric Bond and Share Co. of New York. A new company, Chemical Construction (Great Britain) has been formed with a nominal capital of £100,000, to take over E.B. & S.'s new asset.

A similar operation occurred in the US recently when E.B. & S. acquired the Chemical Construction Corp., owned by the American Cyanamid Company. It is understood that these construction companies will collaborate in engineering design and plant construction for the chemical and petrochemical industries. The Chemical Construction organisation has engineered and built plants which are responsible for nearly 25 per cent of the world's synthetic ammonia and 35 per cent of its sulphuric acid.

Exports for November

TOTAL value of exports of chemicals from the UK in November was £22,590,747, compared with £22,813,645 for October and £20,557,445 for November 1955.

Three countries imported more than a million pounds worth of British chemicals. They were: India, £1,927,813; Australia, £1,692,614; and Canada, £1,000,093.

A breakdown of exports into eight sections follows:

	£
Basic chemical elements & compounds	5,243,689
Coal tar products	428,119
Synthetic dyestuffs	830,161
Paints, pigments & tannins	2,105,068
Medicinal & pharmaceutical products	3,573,744
Essential oils, perfumes, soaps, polishes, etc.	2,480,068
Fertilisers	67,526
Plastics	2,702,951

Expansion at Greenwich

TO IMPROVE the efficiency of the supply of industrial and medical gases, British Oxygen Gases Ltd. has made major structural alterations to its premises at Tunnel Avenue, Greenwich, London SE, at a cost of nearly £50,000.

At Greenwich BOG manufactures gaseous oxygen and nitrogen, compressed air and coal gas. It also supplies hydrogen, dissolved acetylene, propane and argon. Some three million cubic feet of gases in cylinders is supplied each week from the factory.

NOTE & COMMENT

DANGERS OF OZONE

THERE is a long-standing belief that air which contains ozone is stimulating. However, exposure to ozone is a hazard to those engaged in its preparation and use and to those working in proximity to high-voltage electrical equipment and ultra-violet lamps.

Ozone is used in industry as an oxidising agent in the production of peroxide and the bleaching of oils, fats, flour, starch, sugar and textiles.

Symptoms of poisoning have occurred in technicians who use spectrographs with an electric-spark light source. A concentration of as much as 1 p.p.m. has been found after a spectrograph has been in use for one hour. Ozone is also a hazard to welders working in confined spaces since the gas is formed in small amounts by the electric arc in welding operations. Recently three cases of poisoning have been described in men using the new consumable electrode gas-shielded arc welding technique (*Amer. J. med. Sci.*, 1956, **231**, 638). The concentration was high—9.2 p.p.m. (accepted safe limit is 0.1 p.p.m. ozone).

Inhaled in sufficiently high concentrations, ozone gives rise to pulmonary oedema, and haemorrhage. Early symptoms in man are burning and smarting of the eyes and nose, headache, and lethargy. Low concentrations put some people to sleep. Irritation of the upper chest is noticed, and later headache and a sense of oppression. Expired air contains no ozone and experiments have shown that 75 per cent of inhaled ozone is destroyed in the upper respiratory tract.

Residual symptoms are fatigability, weakness, dyspnoea on exertion and loss of weight, which have been known to persist up to nine months after severe poisoning.

GERMAN CHEMICAL INDUSTRY

SOME INTERESTING CONCLUSIONS in respect of the financial structure, investments and liquidity of the West German chemical industry, are drawn from an analysis of the 1954/55 balance sheets of 38 German chemical companies published in the November issue of *Chemische Industrie*. Capital assets have advanced by 26 per cent and by virtue of the increased volume of the balance sheets (of approximately 21 per cent) their proportion of the total balance has increased to almost 50 per cent. This is due to the high investments which totalled DM 1.35 to 1.45 billion in 1955 for the entire chemical industry.

Rationalisation and modernisation have been marked in the German chemical industry. The importance of depreciation as an instrument of finance continues to decline. In 1953, it is stated, more than 80 per cent

of gross investments could be written off, but only 56 per cent in 1954, and in 1955 the figure was under 50 per cent.

Since in 1955, capital raised by financing (including reserves) for the first time slightly exceeded the total of the concerns' share capital and reserve funds, it is evident that the West German chemical industry is undercapitalised.

Under a new Five Year Plan drawn up by the German Democratic Republic (DDR) basic industries and general engineering are to be given preferential treatment and are to be enlarged as rapidly as possible. Attention is now to be paid to their profitable operation. The production figures aimed at indicate, however, a slowing up in the rate of industrialisation, although the amount to be invested is 93 per cent more than that for the first Five Year Plan.

German industrial development is to be based on brown coal. In 1955, over 200 million tons were mined, exceeding the production of any other country. The target for 1960 is 260 million tons.

Production in West Germany's chemical industry is to be increased by 92.7 per cent. Basic chemical production is to be advanced by 50 per cent. The output figure suggested for nitrogen in 1960 is 450,000 tons, most of it (400,000) at Leuna. West Germany's potash industry is to be completely modernised, and, with half the present number of workers, is to produce 2,200,000 tons of potassium oxide (K_2O) in 1960.

AGEING OF PLASTIC MATERIALS

RESEARCH on natural outdoor-ageing processes of plastics materials, particularly nylon, compared with ageing processes under accelerated conditions in the laboratory has been carried out by the Battelle Institute. It has been found that GR-S synthetic rubber and vinyl plastic were most resistant to degradation. Samples of nylon, GR-S synthetic rubber and vinyl plastic were exposed in several different geographical localities and climates over a period of two years.

Principal factors affecting the degradation of nylon are ultra-violet light and heat. Nylon filaments heated in a circulating air oven at 140 °C for eight days showed deterioration corresponding to that which occurs naturally in several months. Natural ageing produces embrittlement and loss of tensile strength. Moisture, although of importance in affecting instantaneous physical properties of nylon, is not of importance in breaking down clusters of atoms or molecules in nylon materials. Ultraviolet light and heat, however, split the nylon molecules into smaller clusters, thereby destroying the basic structure of the material.

Chemical Plant Safety Working

CHIEF INSPECTOR OF FACTORIES' REPORT

SIR GEORGE BARNETT'S annual reports always deserve careful study by the chemical and allied industries, and the one for 1955 published recently (THE CHEMICAL AGE, 8 December) by HMSO (price 9s) particularly does so because he has devoted several pages to reviews, respectively, of the working of the Chemical Works Regulations, 1922, and of the India-rubber Regulations, 1922 and 1955.

In the course of the introduction, the report states that changes in methods of production and alterations in factory layout usually result in improved working conditions. First of the examples quoted is of a chemical works at which a Kachkaroff sulphuric acid plant has been installed. The gas passes from the rotary burners to the reaction towers, coolers and denitration tower. The acid is then conveyed to the concentrating chambers, filters and storage tanks from which it is drawn off for despatch in tank wagons. The whole process, which is continuous, is handled by remote control.

New Hazards

Several inspectors stressed that new methods of production brought new hazards in more complicated form. For instance, chemical, electrical and engineering hazards might be found together in one plant; the old clear borderline between trades tended to disappear. Sometimes methods of production have had to be redesigned to meet the requirements of the Factories Acts.

The report discusses 'automation' in four groups. Group 3 opens with a statement that automatic electrical or electronic controls of continuous manufacturing processes, e.g., oil refining and chemical engineering in which liquids, gases and powdered solids are handled in bulk, are already well established. The techniques of these controls are being rapidly further advanced. They are highly ingenious instrumentally and mathematically and enable processes to be carried out with a precision and on a scale hardly visualised a few years ago.

A description is given of how a firm copes with the problem of protection of tanks, vats or vessels of which the edges are level with the floor, and which contain scalding, corrosive or poisonous liquids, when unrestricted access is required. They suspend the guard-rails from the roof. This arrangement allows an uninterrupted space below the bars through which work can be put in and taken out of their pickling plants.

Reference is made to two valuable safety procedures at a chemical works during the year. One of these was the system of handing over plant from supervisors to

fitters and vice versa, because it was found that this was when some of the mishaps occurred. The Chief Inspector goes on to say that the proper use of 'permit-to-work' systems, as stressed in his report for 1954, can play an important part in reducing accidents at these stages. Present readers will, of course, have some acquaintance with 'permit-to-work' principles from regulation 7 of the Chemical Works Regulations.

At the same chemical works, useful suggestions for safety sometimes come from the medical officer, who examines all employees at frequent intervals, as there is a considerable health risk. The men tend to talk to him and to suggest improvements. The firm has also put on an attractive display of gloves, boots, goggles and respirators in a corridor near the washing facilities. A container which exploded was put in the display-case to warn the men against putting anything inflammable near a source of heat.

On the subject of artificial respiration in cases of electric shock, Sir George points out that it is of the greatest importance that artificial respiration be started at once and continued for at least an hour, preferably two hours. In fact he observes that even if a medical practitioner states that life is extinct, continued artificial respiration can do no harm and there are several cases on record where the victim's co-workers have persisted in spite of such advice and have eventually succeeded in resuscitating him.

A striking example is given of the value of illustrated instructions on how to act in cases of electric shock. A fitter was rendered unconscious. One of his colleagues remembered where the electric shock placard was located, procured it, and immediately began treatment, being guided by the instructions and illustrations thereon. The injured man regained consciousness after about 20 minutes' application and suffered no permanent injuries.

Fires and Explosions

In chapter eight, 'Fires and Explosions,' the Chief Inspector warns that a great deal could be achieved by comparatively simple precautions if the dangers associated with inflammable liquids were more clearly understood by both management and workers. It is, however, first necessary to know whether the liquids kept or used are in fact inflammable and, if so, how inflammable.

One of the difficulties is, according to the Petroleum (Consolidation) Act, 1928, that the containers for a limited number of the more volatile inflammable liquids have to be marked 'Petroleum Spirit, Highly Inflammable' or 'Petroleum Mixture giving off an

Inflammable Heavy Vapour,' whereas many equally dangerous liquids can legally be sold and kept in containers without any warning mark. An improvement in this position is foreshadowed in the report as a result of the scheme for container-marking introduced by the Association of British Chemical Manufacturers.

Chapter 15: 'Industrial Poisoning—Gassing Cases' includes an interesting account of an accident in a chemical factory. Here, the normal process of treating liquors containing excess sulphide or hydrosulphide was to add hydrochloric acid in special enclosed reaction vessels fitted with exhaust ventilation.

Sulphuretted Hydrogen Danger

A process man, having shovelled residues in the form of a sludge from a cask into the reaction vessels, found that some of the residues had solidified at the bottom of the cask. In order to thin them down, he added hydrochloric acid direct to the contents of the cask, when there was an immediate evolution of sulphuretted hydrogen. He left the shed and shouted a warning to another workman; but both men were overcome when they attempted to open the windows, and were rescued by a third workman who was attracted by their calls. Both men were unconscious for some hours and were given oxygen treatment by the works medical officer before removal, under his supervision, to hospital.

Blast furnace gas, power gas, coal gas, carbon monoxide, ammonia, benzol and benzene were variously responsible for 255 cases of gassing (11 fatalities).

Lead poisoning showed an increase over 1954—69 cases compared with 49. The largest number (18) were reported in the category of 'other contact with molten lead,' which included lead welding of the interiors of large steel vessels, scrap metal refining and the quenching of steel mixes in a lead bath.

Two cases of phosphorus poisoning, the first reported since 1944, were in the form of necrosis of the jaw and occurred in two men employed in a factory manufacturing phosphorus in electric furnaces from phosphatic rock.

Industrial Poisoning Fatality

The one fatal case of industrial poisoning reported for 1955 was that of a man who had occasionally used a paint-stripper containing upwards of 60 per cent of benzene for 19 years but who had had no exposure to benzene for five years before symptoms developed. The case was notified to the hospital as 'toxic anaemia,' which led to an investigation of his occupational history and discovery of his long exposure to benzol.

Chapter 18, entitled 'The Chemical Works Regulations, 1922,' abounds in items of interest. It opens with a statement that in recent years there has been a profound change in the chemical industry in this country. The manufacture of heavy chemicals has increased considerably and there has been a tendency for this work to be concentrated in a comparatively small number of large factories controlled by large organisations.

Problems associated with the extended use of chemicals in all branches of industry are discussed; and mention is made that many processes in the fine

RUBBER REVIEWED

Synthetic v Natural Product

REVIEWING rubber consumption and sales by the US rubber industry, the president of the US Rubber Manufacturers' Association stated that the US ratio of synthetic rubber to total new rubber consumption had continued to rise in 1956.

In 1955, synthetic rubber consumption totalled 58.50 per cent, natural, 41.50 per cent; in 1956 the synthetic total is 60.9 per cent and natural, 39.1 per cent. By 1960, some industry sources believe that synthetic rubber consumption will have reached or exceeded 62 per cent. As it is, it is predicted that synthetic rubber output in the US this year will exceed 1 million tons for the first time.

It is concluded that this increase in output and consumption of synthetic rubber has been the reason for the reduction in the price of styrene just recently announced by US chemical companies. The price of styrene has been reduced to 12 cents a pound in contracts taking effect after 1 July. The current price of styrene is quoted as 16 cents a pound.

Unfortunately, as far as the UK and Western Europe are concerned it seems likely that synthetic rubber prices will rise due to the present difficulties involving oil. The higher costs of raw materials, power and plant maintenance have produced reductions in profit margins in established chemical industries. How then is the very new synthetic rubber industry in the UK to cope with reductions in raw materials and fuel with consequent uneconomic sums? It is to be hoped that there will be a marked improvement in the oil situation with regard to both supply and cost for otherwise the UK synthetic rubber industry is liable to suffer a setback and the US will increase its synthetic rubber export markets.

chemical industry are not subject to the Chemical Works Regulations, although these may be applicable to a small part of the process (e.g. the use of chlorine). It is, however, gratifying to note that inspectors find generally that occupiers adopt precautions which are in line with the regulations. They also follow codes of practice and advisory leaflets issued by the manufacturers' associations both in this country and abroad, and often consult the Factory Department when new processes are to begin.

Inspectors report a high standard of lighting in modern chemical works. Even where inflammable or explosive conditions exist, safe forms of lighting are used which achieve a standard of illumination in excess of that required by Regulation 4(a).

Sir George Barnett's comments on the unsatisfactory (or lack of) examination and maintenance of breathing and resuscitation apparatus and life-belts in a number of chemical works should be taken seriously and urgently to heart. The necessity for training a sufficient number of persons in the use of this gear is urged. Another very important point made by him is: 'All workers in departments in which fumes are liable to be evolved must become proficient in the use of breathing apparatus.'

Sulphuric Acid Plant

A \$3 million sulphuric acid plant at Copper Cliff, near Sudbury, Ontario, is being planned by Canadian Industries Ltd. Capable of converting waste into sulphuric acid at the rate of 300 tons a day, the plant will be ready by next December.

The acid-producing process is similar to that used at the plant adjoining International Nickel's Copper Cliff smelter and eliminates the need for burning elemental sulphur by using waste gases from iron production. The acid will be used in extracting uranium concentrates from ore produced by the Stanrock Uranium Mines and Stanleigh Uranium Mines.

Preserving Timber

A SIMPLE DIFFUSION PROCESS for the preservation treatment of green building timbers has been announced in Australia by the Forest Products Division of the Australian Commonwealth Scientific and Industrial Research Organisation in Melbourne. The green timber is treated with a preservative containing a boron and fluorine compound. Penetration occurs in the heartwood and sapwood. Addition of an arsenic and a chromium compound are recommended by the Division, both to increase toxicity and to increase the total quantity of preservative in the solution.

Hess Products Office

HEAD SALES OFFICE of Hess Products Ltd., manufacturers of Distec fatty acids, has moved to 147 Kirkgate Road, Leeds 3. Telephone number (30194) and the telegraphic address are unchanged. The offices are at the works of Adolph Hess & Bro. Ltd., makers of stearines and oleines from wool grease and tallow. Hess Products also produce the Armour range of nitrogen derivatives.

Dutch Plastics Tubes

IN THE ANNUAL REPORT of NV Metaalbuizenfabriek Maatschappij Excelsio of Schiedam, Netherlands, it is announced that this company, which, until now has specialised in steel tubes and pipes, is also undertaking the manufacture of plastics and other special purpose pipes (mention of steel companies with plastics pipes divisions was made in THE CHEMICAL AGE, 15 December).

Underground Gasification

Consultants Appointed by NCB

THE National Coal Board has appointed Sir Alexander Gibb & Partners in association with Messrs. Cremer & Brearley to act as its consultants in carrying out the development of underground gasification. Humphreys & Glasgow Ltd. has been appointed main contractor for the engineering and scientific work.

A pilot scheme should be in operation by the end of 1958 at Newman Spinney, near Barlborough on the border of Yorkshire and Derbyshire. The coal seam chosen for gasification is of secondary quality and is not worth mining because of its high ash content. It is hoped that underground gasification may provide a means of using the country's reserves of poor quality coal.

A scheme to provide gas for a full-sized power station will be planned while work proceeds on the pilot scheme. The National Coal Board states that there are many technical problems yet to be solved, and the economics of the process have still to be determined.

PAN AMERICAN'S SULPHUR OUTPUT

RECENTLY the millionth ton of sulphur was produced from Pan American Sulphur Co. Jaltipan Dome in Veracruz, Mexico. This company has grown, in less than two years of operation, to be the third largest Frasch sulphur producing company in the world.

In 1956, Pan American's first complete year of production and shipping, the company will produce more than 600,000 tons of sulphur. Current production is at the rate of 2,000 tons per day. Over 400,000 tons of sulphur will be shipped this year to customers all over the world.

It is estimated that production next year will be more than 700,000 tons from the firm's 23,300-acre concession on the Isthmus of Tehuantepec in Southern Mexico. Originally the plant was capable of heating 3.3 million gallons of water daily, but with the expansion programme now completed, the plant's capacity is increased to more than five million gallons daily and can produce over a million tons of sulphur per year. Water ratios for current production are slightly more than 1,000 gallons per ton of sulphur produced.

At the close of 1956, it is estimated that Pan American Sulphur Co. will have stockpiled just under 500,000 tons of sulphur. It is planned to main-

US Chemical Sales

ACCORDING to the US Manufacturing Chemists Association, record sales for the US chemical industry will continue into the first half of 1957. Volume of sales for 1956 is estimated at about \$24,000 million, an increase of 4 per cent over 1955.

Because of the dollar shortage outside the US caused by the Suez Canal blockage, however, exports of chemical products are expected to show some decline in coming months.

Christmas Island

PROGRESS is being made in the preparation of a base for Britain's nuclear tests next year on Christmas Island in the Pacific. This U-shaped atoll measures some 50 miles from tip-to-tip. Army units, helped by native labour, have already completed 25 miles of good class roads, an auxiliary airstrip and a bomber runway.

Mail and fresh food are flown in from Honolulu by the RAF. The Royal Navy has made successful landings on Malden Island, a smaller atoll 400 miles to the south.

tain an inventory of about 600,000 tons, with production geared appropriately.

In anticipation of greater shipments next year, Pan American expects to start construction immediately of additional loading and docking facilities to augment the company's present deepwater installation at Puerto Mexico. Design plans have already been completed.

DMH Bibliography

A NEW BIBLIOGRAPHY on dimethylhydantoin (DMH) is now available on application to Glyco Products Co., Inc., Empire State Building, New York 1, NY, U.S. References on physical properties and chemical reactions for this new commercial product are given. These references cover reactions with mineral acids, alkalies, acetic anhydride, methylating agents, chlorine, formaldehyde and noble metal salts. Some of the reaction products shown are alpha-amino isobutyric acid, 1-nitro-5,5-dimethylhydantoin, 1-acetyl-dimethylhydantoin, alpha-ureido isobutyric acid, 3,5,5-trimethylhydantoin, chlorodimethylhydantoin, silver and gold dimethylhydantoin salts, methylol-dimethylhydantoin, methylene-bis-(dimethylhydantoin).

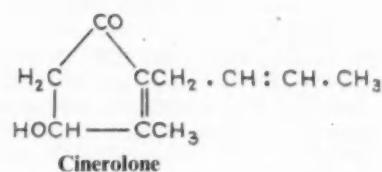
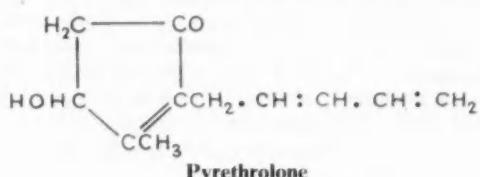
by
R. G. Barradas

Chemical Aspects of Pyrethrum Analysis—Part I

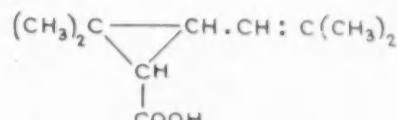
PYRETHRUM flowers (synonyms: insect flowers; Dalmatian insect flowers; Persian insect flowers; Persian pellitory) have found wide applications in insecticidal practice for a long time. The active principle in pyrethrum is found in the flowerheads of certain plants of the chrysanthemum genus, family *Compositae*. From this very large family only three have been found to be useful as insecticides. They are *Chrysanthemum roseum* Web. and Mohr, *Chrysanthemum marshalli* Achi., and *Chrysanthemum cinerariaefolium* Trey.

folium TCV. Of these three forms the last is by far the most important commercially. The flowerheads of *Chrysanthemum cinerariae folium* contain about one per cent of total pyrethrins and cinerins, calculated as pyrethrins. At least one half of the total pyrethrins is composed of pyrethrin-I and the remainder is composed of pyrethrin-II. The pyrethrins, or active insecticidal components of pyrethrum, are the esters of two acids and pyrethrolone which is a complex mixture of two keto-alcohols.

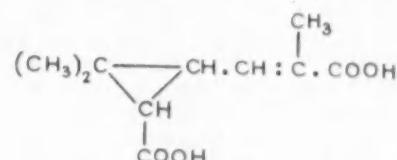
Pyrethrolone, originally believed to be a homogeneous substance, has been shown by West (1) and Barthel and La Forge (2) to be composed of pyrethrolone ($C_8H_8O_2$) and cinerolone ($C_8H_6O_2$). These authors have also shown that both pyrethrin-I and pyrethrin-II yield mixtures of these keto-alcohols on hydrolysis.



The insecticidal properties of pyrethrum flower are due to the presence of the two groups of esters. The first group consists of pyrethrin-I and cinerin-I, both of which have chrysanthemum monocarboxylic acid or chrysanthemic acid as their acid component. The determination of pyrethrin-I, which is based on the determination of total monocarboxylic acid, will therefore include cinerin-I. Similar remarks apply to the assay of pyrethrin-II which includes cinerin-II, because both of these substances of the second group have the monomethyl ester of chrysanthemum dicarboxylic acid (or pyrethic acid) as their acid component.



Chrysanthemum Monocarboxylic Acid

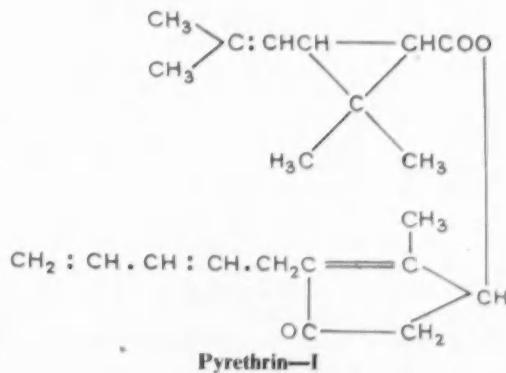


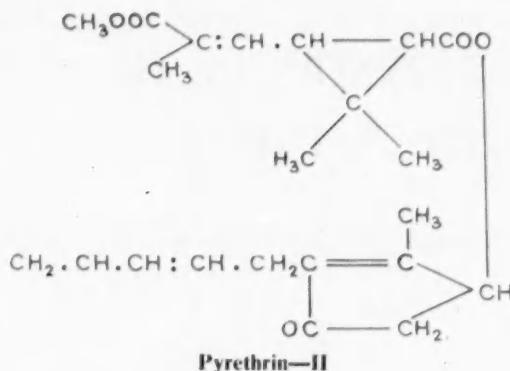
Chrysanthemum Dicarboxylic Acid

The terms pyrethrin-I and pyrethrin-II can now be regarded as referring only to variable mixtures of esters of the two corresponding acids, namely, chrysanthemum monocarboxylic acid and chrysanthemum dicarboxylic acid. Pyrethrin-I has been reported (3, 4) as being more active as an insecticide than pyrethrin-II, and for that reason much attention has been given to methods of evaluating each separately rather than together.

Ripert and Gaudin (5) reported that the biological activity of pyrethrum was not correlated with a definite entity or group, and they further asserted that a mixture of the two pyrethrins was more toxic than either of the two isolated principles. Gersdorff (6) showed that pyrethrin-I and cinerin-I were considerably more active than pyrethrin-II and cinerin-II, and that the pyrethrins were more active than the corresponding cinerins.

The pyrethrins are non-volatile liquids, generally incompatible with alkalis, and are only very slightly soluble in water. The esters of cinerolone are the cinerins-I and II—the suffixes denoting the esters of the mono- and dicarboxylic chrysanthemum acids respectively. The cinerins decompose on hydrolysis with the formation of cinerolone and the respective chrysanthemum carboxylic acid.





Pyrethrin-II

All the ester constituents of pyrethrum are powerful contact insecticides which cause a rapid paralysis of the treated insect. They lack persistence and are thus used for direct contact action to which most insects are highly susceptible. The esters are not only readily hydrolysed by alkali, but they also decompose by the action of sunlight. Such chemical changes always result in the loss of insecticidal properties. Pyrethrum flowers, when ground, show a constant loss of pyrethrin content over a period of months or even years.

Pyrethrum extracts, usually in some mineral oil solvent, have been widely used as sprays against houseflies. They have also found much success in the control of ants, bedbugs, fleas and cockroaches. Various preparations of pyrethrum have been formulated for use on field crops. The use of such insecticidal preparations is very profitable because the monetary return per acre of crop land is high.

From the point of view of human health, pyrethrum has the advantage over many other insecticides that it is not harmful to humans, and does not leave an undesirable toxic residue. Since the action of pyrethrum is one of paralysis or 'knock-down,' rather than of outright killing, most pyrethrum preparations are made to include synergists and other insecticidal compounds such as rotenone, thiocyanates etc. To avoid the loss of activity in pyrethrum through storage over long periods, or through decomposition by the action of sunlight, anti-oxidants such as tannic acid, resorcinol and other substances have sometimes been recommended as additives.

Preparation of Concentrates

The variation in the content of the active constituents of pyrethrum, and the general recognition that grinding of the flowerheads does not release the full value, led to the general practice of extraction and the preparation of concentrates.

During the course of its use, standards became necessary for the various formulations of pyrethrum available on the market. This led to the important task of developing standard methods of evaluating pyrethrum. In the beginning it was assessed on the basis of the ether extract, the colour and proportion of the volatile matter in which being taken as a measure of its quality. It was obvious that such an unscientific method could not be relied upon for long. As more information became available regarding the structure and properties of the cinerins and pyrethrins the problem of analysis became more simple.

CHEMICAL ASPECTS OF

In 1920 McDonnell and his co-workers (7) showed that the active ingredients of pyrethrum were the two closely related pyrethrins. Four years later, Staudinger and Ruzika (8) developed a method of determining the pyrethrins separately. This method resulted in the formation of chrysanthemum monocarboxylic acid and chrysanthemum dicarboxylic acid which by further treatment yielded pyrethrin-I and pyrethrin-II respectively. Many further contributions were made towards the standardisation of methods for determining the two pyrethrins separately by a large field of international scientific workers.

Despite the progress made in the analytical and structural organic chemistry of the pyrethrins there remained much to be desired by way of a suitable, accurate, rapid and reproducible method of analysis. Most of the procedures published gave rise to conflicting results and much controversy on the subject ensued.

Of all the published methods available between 1930 and 1940, two titrimetric procedures received most of the attention from chemists who specialised in this field. The two methods were those suggested by Seil (9, 10) originally in 1934 and that of Wilcoxon (11) in 1936 (with modifications in 1947).

Review of Methods

Martin (12) in 1938 reviewed the existing methods of analysis and suggested that in view of the variation in results, the method of analysis for the determination of pyrethrins should be more clearly enunciated. Further emphasis on this point was made by the sub-committee of the Imperial Institute Consultative Committee on Insecticide Materials of Vegetable Origin in their 1950 London report. The sub-committee could not recommend any particular method which could be preferentially adopted as a standard official method. Most of the methods devised up to this time were not uniform in technique and did not give rise to concordant results. The exact method of analysis and any modifications applied should be clearly stated because this is very important in any transaction between the commercial buyer and seller of pyrethrum.

One of the two methods which received much attention was that of Seil involving the conversion by saponification with ethanolic sodium hydroxide solution of the pyrethrins-I and II to the respective chrysanthemum acids which were then converted to their soluble barium salts by the addition of barium chloride, and were subsequently liberated by the addition of sulphuric acid. The volatile chrysanthemum monocarboxylic acid which was formed from pyrethrin-I was removed by steam distillation and determined by titration with standard sodium hydroxide using phenolphthalein as indicator.

The residue from the steam distillation contained the chrysanthemum dicarboxylic acid derived from pyrethrin-II. This second chrysanthemum acid was extracted with ether, and the residual extract after removal of the solvent was dissolved in boiling water. The aqueous solution was then cooled and titrated with standard sodium hydroxide with phenolphthalein as indicator. This method is of advantage in that with

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other methods only the total pyrethrins could be estimated.

Since this method depends on the actual liberation of the chrysanthemum acids from the pyrethrins it will be obvious that if there were free chrysanthemum acids present in the original sample, or produced by hydrolysis and not removed by special purification, they would be included in the final determination and would give rise to high results. Fortunately, the error is not very large because the method is based on the saponification of a petroleum ether extract of the sample.

The Seil method gave low and variable results for pyrethrin-I owing to the partial loss of chrysanthemum monocarboxylic acid in the steam distillation. This was pointed out by Martin (12) who also suggested that this error could be partly compensated by the presence of steam-volatile acidic substances which may be included in the titration of the monocarboxylic acid.

The results for pyrethrin-II were found to be slightly high. Mitchell *et al.* (13) attributed these inaccuracies to a temperature effect, and claimed that they were independent of the presence of the mineral acid added during the course of the determination. Mitchell and his co-workers also used a modified Seil method which avoided steam distillation and the use of mineral acid, and they obtained accurate figures for total pyrethrins.

Mercury Reduction Method

Wilcoxon (11) originally described a mercury-reduction technique for the determination of pyrethrin-I, and this was modified by Holaday (14). The Wilcoxon-Holaday method was almost identical in principle to that of Seil in the preliminary stage. It was based on the petroleum ether extract being saponified by alcoholic sodium hydroxide solution, and the mixture of the two chrysanthemum acids liberated by the addition of mineral acid. The monocarboxylic acid was quantitatively removed by petroleum ether. Actually the solvent does also remove some of the dicarboxylic acid but the amount removed is very small and does not materially affect the results.

The monocarboxylic acid is allowed to react with Déniges' reagent (a solution of mercuric sulphate prepared by mixing 5.0 g. of mercuric oxide with 40 ml. of water, followed by the addition of 20 ml. of concentrated sulphuric acid and another 40 ml. of water). The mixture is stirred until all the mercuric oxide has dissolved, then allowed to cool and filtered in the presence of hydrochloric acid, iodine monochloride and chloroform (or carbon tetrachloride). The reaction mixture was then titrated with a standard potassium iodate solution until the chloroform (or carbon tetrachloride) layer of the mixture no longer showed a pink colour. As the end-point was not a permanent one the titration was performed rapidly to completion with vigorous shaking after addition of the standard iodate solution. The chrysanthemum dicarboxylic acid was extracted and determined in the normal way by simple alkalimetry.

Generally, the results showed that normal figures were obtained for the monocarboxylic acid, but the

figures for the dicarboxylic acid determination were low to the expected extent. This difficulty could be overcome by a two-stage extraction with light petroleum ether, and experiments with pure chrysanthemum acids have shown that by employing such a modification more than a 99 per cent recovery of both acids could be achieved.

Martin and Brightwell (15) described a method for the determination of pyrethrins in extracts of pyrethrum in heavy mineral oils. It was based on the Wilcoxon-Holaday method with the following modifications: The uncombined acids were removed by extracting a chloroformic solution of the concentrate with dilute barium hydroxide solution. The oil was removed by fractionating the saponified concentrate between water and light petroleum. The chrysanthemum monocarboxylic acid was extracted in the presence of the barium sulphate precipitate, and the light petroleum solution was washed with two successive half volumes of water instead of one washing with the full amount prescribed.

Incorporated in BPC

The Wilcoxon-Holaday mercury reduction method has been officially incorporated into the *British Pharmaceutical Codex*, and the Seil method in the *Association of Official Agricultural Chemists (AOAC) Handbook of Official Methods of Analysis*.

Mitchell and Tresadern (16) reported that the use of a warm solvent in a Soxhlet extraction method gave erroneously high results for the determination of pyrethrin-II. This was especially true when the higher boiling grades of light petroleum ether were used. Lower results for pyrethrin-II were obtained by a cold extraction procedure, and the variations in the results obtained with different grades of petroleum ether were largely eliminated. Mitchell (17) also showed that when tested by a modified Peet-Grady biological method, pyrethrum extracted with cold petroleum ether had normal insecticidal activity. When the residue from this treatment was extracted with the same solvent at 39.5°C, and then with chloroform at 59°C, the respective extracts had no insecticidal activity.

Cold Extraction Recommended

It was recommended that pyrethrum flowers be extracted only with cold petroleum ether having a boiling range of 40-60°C or 20-40°C. Mitchell suggested that hot solvents extracted 'additional pyrethrins' which were non-toxic to houseflies.

In 1952 the Association of Official Agricultural Chemists' (7th official edition 1950) mercury reduction method was modified by using hydrochloric acid in place of sulphuric acid in the pyrethrin-I separation. The bicarbonate neutralisation and chloroform extraction step in the pyrethrin-II determination were omitted. These modifications gave rise to a higher (15-20 per cent) pyrethrin-I content than did the original method. This was said to be due to the inclusion of some unidentified compound which is occluded in the barium sulphate precipitate obtained if acidification with sulphuric acid was used as in the original AOAC method.

Mitchell (18) indicated from experimental evidence that the modified AOAC method was an improvement

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on the original. The modified method was subsequently rescinded and Mitchell's evidence inferred that this decision was an unfortunate one. He published evidence to show that the material occluded with the precipitate should in fact be calculated as pyrethrin-I and that the sulphate method therefore gave low results.

A new method for the assay of pyrethrin based on the determination of the chrysanthemic acids by simple alkalimetry was described by Mitchell (19). Pyrethrum flowers were extracted with cold light petroleum ether (boiling range 40-60°C) and the extract was boiled with 0.5N potassium hydroxide in ethylene glycol monomethyl ether (Cellosolve), treated with an aqueous solution of barium chloride and filtered. The filtrate was acidified and extracted with light petroleum. The resulting petroleum extracts were titrated as in the Seil method with 0.02N sodium hydroxide solution to give pyrethrin-I, and the petroleum extracted aqueous acid liquors were analysed for pyrethrin-II by the AOAC method.

Recently Mitchell and Tresadern (20) recommended an additional stage in the AOAC method for the determination of pyrethrin-II. The chrysanthemum dicarboxylic acid, being readily soluble in boiling water, was separated from water-insoluble acidic matter before titration. The residue, after evaporation of the ether, was boiled in 75 ml. of distilled water and filtered hot. The residues in the dish and filter paper were washed with boiling water until the filtrates were neutral to litmus. These washings required not less than five 20 ml. portions of boiling water. The combined filtrates were then titrated with 0.02N sodium hydroxide solution to phenolphthalein. By this additional modification the accuracy of the pyrethrin-II determination was improved.

Variable Results

A third titrimetric method which received a considerable amount of attention was that due to Ripert (21, 22). His method was based on the solubility in water of the barium salts of chrysanthemum mono- and dicarboxylic acids. Ripert's method was found to give so many variable results that it was considered unsuitable for acceptance as a standard method.

A collaborative investigation (20) into chemical and biological methods for the assay of several strains of pyrethrum flowers was initiated by the Colonial Products Advisory Bureau. Reasonable agreements were found between the results of the collaborating laboratories in the United Kingdom and America when fresh and stored flowers of one normal and two high pyrethrin content strains and extracts from these samples were assayed by the AOAC (7th edition) method both in the original (1950) and modified (1952) forms. The modified AOAC method indicated a 15-20 per cent higher pyrethrin-I content than did the original AOAC method. The results recorded by the Bureau showed that no consistent differences were found between the toxicities of the three strains when tested on a variety of insects.

Biological results indicated a greater loss of toxicity on storage of one of high content strain than was shown

by chemical assay. It was therefore inferred that current chemical methods of analysis of high content strains gave results which may not be a reliable indication of the biological activity.

Further results of the comparison of chemical and biological assays of pyrethrum flowers from Tanganyika were reported by Parkin (23). Flowers from three strains of pyrethrum grown in southern Tanganyika were compared for pyrethrin content by chemical assay using the 1952 modification of the AOAC method, and for insecticidal activity by several techniques of biological assay. Considerable differences were found between the results of assay.

Despite the lack of concordance in the results of chemical methods in current use, the situation is not entirely unfavourable. The Seil and Wilcoxon-Holaday methods have gained recognition individually. There is a difference of about 0.3 per cent absolute between the analysis of pyrethrum by the two methods but for flowers containing one and two per cent pyrethrins the discrepancy is not very significant. The difference in results may possibly be even due to errors of sampling procedures. Methods other than those discussed above have been adapted towards the analysis of pyrethrum flowers and extracts. Notable advances have been achieved in the application of colorimetric, spectrophotometric, polarographic, and chromatographic techniques. These other major contributions to the progress of pyrethrum analysis will be discussed in the next part of this review.

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Brine Testing Books

TESTING of brine pH is reduced to the simplest possible procedure with the introduction of the *APV Brine Testing Book*. Each book, which is waistcoat pocket size (2 in. x 3½ in.) contains three Polythene wrapped booklets of papers, covering pH ranges 5.2-6.7, 6.8-8.3 and 8.4-10.0. Colour reference charts within booklet covers make the reading of pH values a simple and accurate task. Each brine testing book is good for at least 20 tests and costs 2s 6d. Supplies can be obtained from The APV Co. Ltd., Manor Royal, Crawley, Sussex.

Commercial Intelligence

New Registrations

Britonia Chemical Co. Ltd.

Private company (575,540). Registered 11 December. Capital £20,000 in £1 shares. Objects: To acquire the business of oil, paint and varnish merchants and manufacturers carried on by John M. Ashworth as Britonia Chemical Company at Preston. The subscribers (each with one share) are: John M. Ashworth, 9 Arundel Road, Ansdell, Lytham St. Annes, paint and chemical manufacturer; and Frank Ashworth, C.A., 128 Church Road, Leyland, nr. Preston. John M. Ashworth will be first managing director. Secretary: F. Ashworth. Solicitors: John Whitehead, Marsden & Huck, Preston. Reg. office: Britonia Works, Isabella Street, Preston.

West End Chemists (Lancashire) Ltd.

Private company (575,331). Registered 7 December. Capital £2,500 in £1 shares. Objects: To carry on the business of wholesale and retail pharmaceutical chemists and druggists etc. The directors are: Neville T. Coupe, Inglesant, Arnold Avenue, Hopwood, Heywood, Lancs, director of J. Smith Hargreaves & Co. Ltd.; Alan J. Ross, Ph.C., 6 Merry Bower Road, Salford 6; John B. Battersby, John F. A. Clough and Harry L. Dutton. Secretary: H. L. Dutton. Reg. office: 92 Bury Street, Heywood, Lancs.

Electrolube Ltd.

Private company (575,334). Registered 7 December. Capital £100 in £1 shares. Objects: To carry on the business of manufacturers and suppliers of and dealers in electrical, radio, television and scientific components, materials and apparatus of all kinds, and to manufacture, buy, sell, process and deal in oil, lubricants, paints and chemical substances of all kinds etc. The first directors are: Henry E. R. Kingsbury and Lady Patricia M. C. Kingsbury, both of Wentworth Lodge, Iver Heath, Bucks (directors, Kingsbury Components Ltd., and Kingsbury Office Equipment Ltd.). Secretary: Lady P. M. C. Kingsbury. Solicitors: Bird & Bird, 2 Grays Inn Square, London WC1. Reg. office: Nuffield House, Piccadilly, London W1.

Seaman Chemists Ltd.

Private company (574,619). Registered 22 November. Capital £100 in £1 shares. Objects: To carry on the business of pharmaceutical, dispensing and analytical chemists and druggists, sight testing and dispensing opticians etc. The directors are: Leslie J. Seaman and Hilda M. Seaman, both of 130 Kingston Road, London SW19. Secretary: Hilda M. Seaman. Registered office: 43 Upper Berkeley Street, London W1.

COMPANY NEWS

ACC-Vickers-Babcock (Private) Ltd. (AVB)

Associated Cement Cos. Ltd., of Bombay, Vickers Ltd., of London, and Babcock & Wilcox Ltd., of London, announce that they have concluded their arrangements for the formation of a company to be known as ACC-Vickers-Babcock (Private) Ltd. (AVB). The new company plans to build a heavy engineering works in the vicinity of Durgapur, West Bengal. The products to be manufactured will include cement-making machinery, mining machinery, large pumps, heavy gears, steam generating plant of all types, pressure vessels, cranes and mechanical handling equipment. The construction of the proposed works will commence as soon as the Government of India's approval, now being sought, has been obtained.

Apex (Trinidad) Oilfields

Profits before tax and development of Apex (Trinidad) Oilfields dropped from £1,621,804 to £1,449,845 in the year ended 30 September 1956. Net profit amounted to £616,845, compared with £683,804 for the previous year. Final dividend on the £1.1 m. capital is raised from 28½ per cent to 30 per cent net, making a total for the year of 35 per cent, tax free, against 33½ per cent.

Anglo-Lautaro Nitrate Group

Anglo-Lautaro's profits for the year ended 30 June 1956 were \$4.39 million or 99 cents per 'A' share, compared with \$3.72 or 84 cents per share last year. The dividend is held at 80 cents per 'A' share for the year. According to the chairman, Mr. H. F. Guggenheim, these earnings are

inadequate when related to the company's investment, replacement value of its properties, and its future capital requirements.

Scottish Agricultural Industries Ltd.

The board of Scottish Agricultural Industries Ltd. recommends a final dividend on the ordinary shares of five per cent (1s per share) less income tax which, together with the interim dividend of three per cent (7s 2d per share) less income tax, makes a total payment for the year ended 30 September 1956 of eight per cent (1s 7.2d per share). This compares with a total dividend for 1955 of 11 per cent (2s 2.4d per share) paid on the old ordinary share capital which has since been increased by a capitalisation issue of two ordinary shares for every five held. Group profit before providing for taxation and after charging all expenses including depreciation amounted to £1,091,373, against £1,162,945 for the previous year. Profit after providing for taxation amounted to £529,379, compared with £513,699 for 1954-55.

Celanese Corp. of America

Directors of Celanese Corporation of America have declared a dividend of 25 cents a share on the common stock, payable 21 December 1956 to holders of record 7 December 1956. The board has also voted regular quarterly dividends of \$12½ on the preferred stock, series A, and \$1.75 on the seven per cent second preferred stock. Both preferred stock dividends are payable 1 January 1957 to holders on record 7 December 1956.

Tate & Lyle Ltd.

Tate & Lyle's unchanged final dividend of 12 per cent maintains the ordinary dividend at 16.5 per cent for the year ended 29 September 1956. Turnover increased by over £1½ million and profits, before tax, amounted to £4,074,531, compared with £4,249,214 for the previous year. Sales of refined sugar for the home market increased from 1,421,557 tons to 1,455,860 tons. The export figure was lower at 552,437 tons against 690,359 tons.

Midland Aluminium Ltd.

References to the wide use of aluminium in chemical engineering and in packaging pharmaceuticals and industry generally are made in the annual statement by the chairman of Midland Aluminium Ltd. (Major C. R. Dibben). Trading profits this year amounted to £164,603. The statement forecasts great developments in aerosols.

British Chemical Prices

(These prices are checked with the manufacturers, but it must be pointed out that in many cases there are variations according to quantity, quality, place of delivery, etc.)

LONDON Quiet conditions have prevailed both in the industrial chemicals market and the coal-tar products market owing to the short holiday week, and buying interest is not expected to be much in evidence until the New Year.

MANCHESTER Trading conditions on the Manchester market during the past week have been under the usual year-end influences. Stoppages of work at the consuming end for the holidays and stocktaking operations have left their mark on the movement of supplies and only a limited amount of fresh business has been reported. There seems to be reasonable confidence about regarding prospects for 1957, though much will depend, so far as home consumption is concerned, upon the state of the cotton textile and allied industries, which are substantial users of a wide range of heavy chemicals.

GLASGOW The overall position in the Scottish heavy chemical market is one of continued activity, and at this time of the year the questions of inquiries and renewals of contracts for the ensuing year are very much to the forefront. Deliveries against current requirements are being well maintained, and in view of the restrictions on petroleum products, every endeavour is being made to sustain continuity of supplies as far as possible. Some prices are showing an upward tendency due to increased costs, but despite this, the bulk of prices are remaining firm, and it will depend on circumstances how long this position can be maintained. Moderate demands are being made in regard to agricultural products, while in export quite a number of inquiries are being received, with a fair percentage of resultant business.

General Chemicals

Acetic Acid.—Per ton: 80% technical, 10 tons, £91; 80% pure, 10 tons, £97; commercial glacial, 10 tons, £99; delivered buyers' premises in returnable barrels (technical acid barrels free); in glass carboys, £8; demijohns, £12 extra.

Acetic Anhydride.—Ton lots d/d, £132 per ton.

Alum.—Ground, about £25 per ton, f.o.r. MANCHESTER: Ground, £25.

Aluminium Sulphate.—Ex-works, £15 10s per ton d/d. MANCHESTER: £15 15s to £18 10s.

Ammonia, Anhydrous.—Is 9d to 2s 3d per lb.

Ammonium Chloride.—Per ton lot, in non-returnable packaging, £29 2s 6d.

Ammonium Nitrate.—D/d, £31 per ton (in 4-ton lots).

Ammonium Persulphate.—MANCHESTER: £6 2s 6d per cwt., in 1-cwt. lots, delivered. £112 10s per ton, in minimum 1-ton lots, delivered.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £106 and £97 10s per ton.

Antimony Sulphide.—Crimson, 4s 5d to 4s 10½d; golden, 2s 8½d to 4s 1½d; all per lb., delivered UK in minimum 1-ton lots.

Arsenic.—Per ton, £45 to £50 ex store.

Barium Carbonate.—Precip., d/d; 4-ton lots, £41 per ton, bag packing.

Barium Chloride.—£49 per ton in 2-ton lots.

Barium Sulphate (Dry Blanc Fixe).—Precip., 2-ton lots, £35 per ton d/d.

Bleaching Powder.—£28 12s. 6d per ton in returnable casks, carriage paid station, in 4-ton lots.

Borax.—Per ton for ton lots, in hessian sacks, carriage paid: Technical, anhydrous, £62 10s; granular, £42; crystal, £44 10s; powder, £45 10s; extra fine powder, £46 10s; BP, granular, £51; crystal, £53 10s; powder, £54 10s; extra fine powder, £55 10s.

Boric Acid.—Per ton for ton lots, in hessian sacks, carriage paid: Technical, granular, £71; crystal, £79; powder, £76 10s; extra fine powder, £78 10s; BP granular, £84; crystal, £91; powder, £88 10s; extra fine powder, £90 10s.

Calcium Chloride.—Per ton lots, in non-returnable packaging: solid and flake, £16.

Chlorine, Liquid.—£38 5s per ton, in returnable 16-17-cwt. drums, delivered address in 3-drum lots.

Chromic Acid.—2s 0½d per lb., less 2½%, d/d UK, in 1-ton lots.

Chromium Sulphate, Basic.—Crystals, 8½d per lb. delivered, £75 16s 8d per ton.

Citric Acid.—1-cwt. lots, £10 5s cwt.

Cobalt Oxide.—Black, delivered, bulk quantities, 13s 2d per lb.

Copper Carbonate.—3s 9d per lb.

Copper Sulphate.—£94 10s per ton f.o.b., less 2% in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £11 12s.

Formaldehyde.—£37 5s. per ton in casks, d/d.

Formic Acid.—85%, £86 10s in 4-ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1.260 SG, £10 1s 6d per cwt., in 5-cwt. drums for annual purchases of over 5-ton lots and under 25 tons. Refined pale straw industrial, 5s per cwt. less than chemically pure.

Hydrochloric Acid.—Spot, about 12s per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s 6d per lb.

Hydrogen Peroxide.—27.5% wt., £128 10s per ton. 35% wt., £158 per ton d/d. Carboys extra and returnable.

Iodine.—Resublimed BP, under 1 cwt. 14s 10d per lb., 13s 11d per lb. for 1-cwt. lots.

Iodoform.—Under 1 cwt. £1 3s 5d per lb; £1 2s 6d per lb. for 1-cwt. lots.

Lactic Acid.—Pale tech., 44% by weight, 14d per lb.; dark tech., 44% by weight, 9d per lb., ex-works; chemical quality, 44% by weight, 12½d per lb., ex-works; 1-ton lots, usual container terms.

Lead Acetate.—White: About £154 per ton.

Lead Nitrate.—About £135 1-ton lots.

Lead, Red.—Basis prices per ton. Genuine dry red, £147; orange lead, £157. Ground in oil: red, £162 15s; orange, £174 15s.

Lead, White.—Basis prices: Dry English in 5-cwt. casks, £149 15s per ton. Ground in oil: English, 1-cwt. lots 194s per cwt.

Lime Acetate.—Brown, ton lots, d/d, £40 per ton; grey, 80-82%, ton lots, d/d, £45 per ton.

Litharge.—£147 per ton, in 5-ton lots.

Magnesite.—Calcined, in bags, ex-works, about £21 per ton.

Magnesium Carbonate.—Light, commercial, d/d, 2-ton lots, £84 10s per ton, under 2 tons, £97 per ton.

Magnesium Chloride.—Solid (ex-wharf), £16 10s per ton.

Magnesium Oxide.—Light, commercial, d/d, under 1-ton lots, £245 per ton.

Magnesium Sulphate.—Crystals, £16 per ton.

Mercuric Chloride.—Technical powder, £1 3s per lb., for 5-cwt. lots, in 28-lb. parcels; smaller quantities dearer.

Mercury Sulphide, Red.—£1 9s 3d per lb., for 5-cwt. lots in 28-lb. parcels.

Nickel Sulphate.—D/d, buyers UK £170 per ton. Nominal.

Nitric Acid.—80° Tw., £35 per ton.

Oxalic Acid.—Home manufacture, minimum 4-ton lots, in 5-cwt. casks, about £131 per ton, carriage paid.

Phosphoric Acid.—Technical (s.g. 1.700) ton lots, carriage paid, £100 per ton; BP (s.g. 1.750), ton lots, carriage paid, 1s 4d per lb.

Potash, Caustic.—Solid, £93 10s per ton for 1-ton lots; liquid, £34 15s.

Potassium Carbonate.—Calcined, 96/98%, about £74 10s per ton for 1-ton lots, ex-store.

Potassium Chloride.—Industrial, 96%, 1-ton lots, about £24 per ton.

Potassium Dichromate.—Crystals and granular, 1s 1½d per lb., in 5-cwt. to 1-ton lots, d/d UK.

Potassium Iodide.—BP, under 1-cwt. 11s 2d per lb.; 10s 8d per lb. for 1-cwt. lots.

Potassium Nitrate.—In 4-ton lots, in non-returnable packaging, paid address, £63 10s per ton.

Potassium Permanganate.—BP, 1-cwt. lots, 1s 9d per lb.; 3-cwt. lots, 1s 8½d per lb.; 5-cwt. lots, 1s 8d per lb.; 1-ton lots, 1s 7½d per lb.; 5-ton lots, 1s 7½d per lb.; Tech., 5-cwt. packed in 1-cwt. drums, £8 14s 6d per cwt.; packed in 1-cwt. drums, £8 9s 6d per cwt.

Salammoniac.—Per ton lot, in non-returnable packaging, £45 10s.

Salicylic Acid.—MANCHESTER: Technical 2s 8½d per lb. d/d.

Soda Ash.—58% ex-depot or d/d, London station, about £16 8s per ton, 1-ton lots.

Soda, Caustic.—Solid 76/77%: spot, £32 6s 6d per ton d/d (4 ton lots).

Sodium Acetate.—Commercial crystals, £91 per ton d/d.

Sodium Bicarbonate.—Per ton lot, in non-returnable packaging, £17.

Sodium Bisulphite.—Powder, 60/62%, £42 15s d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—Per ton lot, in non-returnable packaging, paid address, £57.

Sodium Chlorate.—About £85 per ton in 1-cwt. drums, carriage paid station, in 4-ton lots.

Sodium Cyanide.—96/98%, £113 5s per ton lot in 1-cwt. drums.

Sodium Dichromate.—Crystals, cake and powder, 11½d per lb. Net d/d UK, anhydrous, 1s 1d per lb. Net del. d/d UK, 5-cwt. to 1-ton lots.

Sodium Fluoride.—Delivered, 1-ton lots and over, £5 per cwt.; 1-cwt. lots, £5 10s per cwt.

Sodium Hyposulphite.—Pea crystals, £35 15s a ton; commercial, 1-ton lots, £32 10s per ton, carriage paid.

Sodium Iodide.—BP, under 1 cwt. 15s 1d per lb; 14s 2d per lb. for 1-cwt. lots.

Sodium Metaphosphate (Calgon).—Flaked, paper sacks, £133 per ton.

Sodium Metasilicate.—£25 per ton, d/d UK in ton lots, loaned bags.

Sodium Nitrate.—Chilean refined granulated over 98% 6-ton lots, d/d station, £29 10s per ton.

Sodium Nitrite.—£32 per ton (4-ton lots).

Sodium Percarbonate.—12½% available oxygen, £8 6s 9d per cwt. in 1-cwt. kegs.

Sodium Phosphate.—Per ton d/d for ton lots; di-sodium, crystalline, £40 10s, anhydrous, £88; tri-sodium, crystalline, £39 10s, anhydrous, £86.

Sodium Silicate.—75-84° Tw. Lancashire and Cheshire, 4-ton lots, d/d station in loaned drums, £10 15s per ton; Dorset, Somerset and Devon, £3 17s 6d per ton extra; Scotland and S. Wales, £3 per ton extra. Elsewhere in England, excluding Cornwall and Wales, £1 12s 6d per ton extra.

Sodium Sulphate (Desiccated Glauber's Salts).—D/d in bags ton, £18.

Sodium Sulphate (Glauber's Salt).—£9 5s to £10 5s per ton d/d.

Sodium Sulphate (Salt Cake).—Unground, £6 per ton d/d station in bulk. MANCHESTER: £7 10s per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot, £33 2s 6d per ton, d/d, in drums in 1-ton lots; broken, £34 2s 6d per ton, d/d, in drums in 1-ton lots.

Sodium Sulphite.—Anhydrous, £66 5s per ton; commercial, £25 5s to £27 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £20 to £22, according to fineness.

Sulphuric Acid.—Net, naked at works, 168° Tw. according to quality, per ton, £10 7s 6d to £12; 140° Tw., arsenic free, per ton, £8 12s 6d; 140° Tw., arsenious, per ton, £8 4s 6d.

Tartaric Acid.—Per cwt.: 10 cwt. or more £13 10s, one cwt., £13 15s.

Titanium Oxide.—Standard grade comm., with rutile structure, £172 per ton; standard grade comm., with anatase structure, £154 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d, white seal, £120; green seal, £113; red seal, 2-ton lots, £115 per ton.

Solvents & Plasticisers

Acetone.—Small lots: In 5-gal. cans: 5-gal., £125, 10-gal. and upward, £115, cans included. In 40/45 gal. returnable drums, spot: Less than 1 ton, £90; 1 to less than 5 tons, £87; 5 to less than 10 tons, £86; 10 tons and upward, £85. In tank wagons, spot: 1 to less than 5 tons (min. 400 gal.), £85; 5 to less than 10 tons (1,500 gal.), £84; 10 tons and upward (2,500 gal.), £83; contract rebate, £2. All per ton d/d.

Butyl Acetate BSS.—£165 per ton, in 10-ton lots.

n-Butyl Alcohol BSS.—10 tons, in drums, £152 per ton d/d.

sec-Butyl Alcohol.—5 gal. drums, £159; 40 gal. drums: less than 1 ton, £124 per ton; 1 to 10 tons, £123 per ton; 10 tons and over, £119 per ton; 100 tons and over, £120 per ton.

tert-Butyl Alcohol.—5-gal. drums, £195 10s per ton; 40/45 gal. drums: less than 1 ton, £175 10s per ton; 1 to 5 tons, £174 10s per ton; 5 to 10 tons, £173 10s; 10 tons and over, £172 10s.

Diacetone Alcohol.—Small lots: 5-gal. drums, £177 per ton; 10-gal. drums, £167 per ton. In 40/45 gal. drums: less than 1 ton, £142 per ton; 1 to 9 tons, £141 per ton; 10 to 50 tons, £140 per ton; 50 to 100 tons, £139 per ton; 100 tons and over, £138 per ton.

Dibutyl Phthalate.—In drums, 10 tons, 2s per lb. d/d; 45-gal. drums, 2s 1½d per lb. d/d.

Diethyl Phthalate.—In drums, 10 tons, 1s 11½d per lb. d/d; 45 gal. drums, 2s 1d per lb. d/d.

Dimethyl Phthalate.—In drums, 10 tons, 1s 9½d per lb. d/d; 45 gal. drums, 1s 10½d per lb. d/d.

Diocetyl Phthalate.—In drums, 10 tons, 2s 8d per lb. d/d; 45 gal. drums, 2s 9½d per lb. d/d.

Ether BSS.—In 1 ton lots, 1s 11d per lb.; drums extra.

Ethyl Acetate.—10 ton lots, d/d, £135 per ton.

Ethyl Alcohol (PBS 66 o.p.).—Over 300,000 p. gal., 2s 11½d; 2,500-10,000 p. gal., 3s 1½d per p. gal., d/d in tankers. D/d in 40/45-gal. drums, 1d p.p.g. extra.

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Methanol.—Pure synthetic, d/d, £43 15s per ton.

Methylated Spirit.—Industrial 66° o.p.: 500 gal. and over in tankers, 5s 4d per gal. d/d; 100-499 gal. in drums, 5s 8½d per gal. d/d. Pyridinised 64 o.p.: 500 gal. and over in tankers, 5s 6d per gal. d/d; 100-499 gal. in drums, 5s 10½d per gal. d/d.

Methyl Ethyl Ketone.—10-ton lots, £140 per ton d/d.

Methyl isoButyl Ketone.—10 tons and over, £159 per ton.

isoPropyl Acetate.—In drums, 10 tons, £130 per ton d/d; 45-gal. drums, £136 per ton d/d.

isoPropyl Alcohol.—Small lots: 5-gal. drums, £118 per ton; 10-gal. drums, £108 per ton; in 40-45 gal. drums; less than 1 ton, £83 per ton; 1 to 9 tons, £81 per ton; 10 to 50 tons, £80 10s per ton; 50 tons and over, £80 per ton.

Rubber Chemicals

Carbon Disulphide.—£61 to £67 per ton, according to quality.

Carbon Black.—8d to 1s per lb., according to packing.

Carbon Tetrachloride.—Ton lots, £81 per ton.

India-Rubber Substitutes.—White, 1s 6½d to 1s 10½d per lb.; dark, 1s 3d to 1s 5½d per lb. delivered free to customers' works.

Lithopone.—30%, about £55 per ton.

Mineral Black.—£7 10s to £10 per ton.

Sulphur Chloride.—British, about £50 per ton.

Vegetable Lamp Black.—£64 8s per ton in 2-ton lots.

Vermilion.—Pale or deep, 15s 6d per lb. for 7-lb. lots.

Coal-Tar Products

Benzole.—Per gal., minimum of 200 gals. delivered in bulk, 90's, 6s; pure, 6s 4d.

Carbolic Acid.—Crystals, minimum price 1s 4d per lb. delivered in bulk, ½d per lb. extra in 40/50 gal. returnable drums. Crude, 60's, 8s per gal. MANCHESTER: Crystals, 1s 4d to 1s 7d per lb., d/d crude, 8s naked, at works.

Creosote.—Home trade, 1s to 1s 9d per gal. according to quality, f.o.r. maker's works. MANCHESTER: 1s to 1s 8d per gal.

Cresylic Acid.—Pale 99/100%, 6s 4d per gal.; 99.5/100%, 6s 6d per gal. D/d UK in bulk; Pale ADF from 7s 3d per imperial gallon f.o.b. UK, 95 cents per US gallon, c.i.f. NY.

Naphtha.—Solvent, 90/160°, 6s per gal.; heavy, 90/190°, 4s 11d per gal. for bulk 1,000-gal. lots, d/d. Drums extra; higher prices for smaller lots.

Naphthalene.—Crude, 4-ton lots, in buyers' bags, £21 11s to £35 2s 6d per ton nominal, according to m.p.; hot pressed, £47 7s 6d per ton in bulk ex-works; refined crystals, £68 per ton d/d min. 4-ton lots.

Pitch.—Medium, soft, home trade, £9 per ton f.o.r. suppliers' works; export trade about £10 10s per ton f.o.b. suppliers' port.

Pyridine.—90/160, 20s to £1 2s 6d per gal.

Toluole.—Pure, 6s 9d; 90's 6s per gal. d/d. 1,000 gal. in bulk. MANCHESTER: Pure, 6s 7½d per gal. naked.

Xylole.—6s 11½d to 7s 5d per gal., according to grade, in 1,000 gal. lots d/d London area in bulk.

Intermediates & Dyes
(Prices Nominal)

m-Cresol 98/100%—4s 9d per lb. d/d.

o-Cresol 30/31°C.—1s per lb. d/d.

p-Cresol 34/35°C.—4s 9d per lb. d/d.

Dichloraniline.—4s 6d per lb.

Dinitrobenzene.—88/99°C., 2s 1d per lb.

Dinitrotoluene.—SP 15° C., 2s 1½d per lb.; SP 26° C., 1s 5d per lb.; SP 33° C., 1s 2½d per lb.; SP 66/68° C., 2s 1d per lb. Drums extra.

p-Nitraniline.—5s 1d per lb.

Nitrobenzene.—Spot, 10d per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—2s 5½d per lb.

o-Toluidine.—1s 11d per lb., in 8/10-cwt. drums, drums extra.

p-Toluidine.—6s 1d per lb., in casks.

Dimethylaniline.—3s 5d per lb., drums extra, carriage paid.



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PATENTS

By permission of the Controller of HM Stationery Office the following extracts are reproduced from the 'Official Journal (Patents).' Copies of this publication may be obtained from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London, WC2, price 2s 6d per copy (including postage); annual subscription £6 6s. The letter P or C preceding the number indicates that the application was accompanied by a provisional specification or a complete specification respectively.

APPLICATIONS

C33721 Sodium hydroxide chlorates &c. removing method. Dow Chemical Co.

P34085 Pulverising apparatus. Leccas, C. M.

C33753 Polyamides coating material preparing method. Algemene Kunstzijde Unie NV.

C34021 Metal sulfide coatings forming method. Alpha Molykote Corp.

C34069 Aluminium silicon alloys crystalline structure refining process. Aluminiumwerke Nurnberg Ges.

C33487 Synthetic resinous composition. American Cyanamid Co.

C34146 Acrylonitrile production. American Cyanamid Co.

C33831 N, N-Diisopropylbenzothiazole-2-sulfenamide. American Cyanamid Co.

C33981 Filamentary polyacrylonitrile producing art. American Cyanamide Co.

C33639 Alpha-chloracrylic acid esters. Badische Anilin & Soda-Fabrik AG.

C33640 Cycloheptene-(1)-carboxylic acid-(1), &c. Badische Anilin & Soda-Fabrik AG.

C33536 Coke oven gases desulphurisation. Bergwerksverband Zur Verwertung von Schutzrechten der Kohlentechnik Ges.

P34040 Organic compounds &c. ozonisation. Boake, Roberts & Co. Ltd.

P33863 Myrene halides hydrolysis. Boake, Roberts & Co. Ltd.

P33686 Chemical compounds purification. British Oxygen Co. Ltd.

C33970 Cyanoalkylamines. Burke, O. W.

C33971 Elastomers. Burke, O. W.

C33972 High vinyl-low diene acidic resins. Burke, O. W.

C34098 Corrosion inhibition. California Research Corporation.

C33499 Phosphate ester compositions. Celanese Corp. of America.

C33668 Solvent recovery. Celanese Corp. of America.

C33998—C34000 Phosphate esters. Celanese Corp. of America.

C34140 Polymers. Celanese Corp. of America.

C33586 Organic phosphorous compounds. Ciba Ltd.

C33910 Pigments &c., dyeing process. Ciba Ltd.

C34029 Metaliferous polyazo-dyestuffs. Ciba Ltd.

C33658 Metallic ores treatment. Columbia-Southern Chemical Corp.

P33476 Arly-benzthiazoles therapeutic derivatives. Crookes Laboratories Ltd.

P34212 Complex metal oxide materials treatment. Department of Mines.

C33472 Liquids purification. Dorr-Oliver Inc.

C33557 Magnesium alloy. Dow Chemical Co.

C34172 Monovinyl-benzene compounds &c. copolymers. Dow Chemical Co.

C33474 Fuel oil compositions. Du Pont de Nemours & Co.

C34034 Polythene film production. Du Pont de Nemours & Co.

C33915—C33584 Refractory metals purification. Du Pont de Nemours & Co.

P33656 Synthetic resin cements. Engel, W. H.

C33835 Fluid coker reactor vapours quench nozzle. Esso Research & Engineering Co.

C33836 Hydroforming process. Esso Research & Engineering Co.

C33837 Copolymer-oil modified butyl rubber. Esso Research & Engineering Co.

C33838 Hydrocarbons irradiation. Esso Research & Engineering Co.

C34195 Chemicals two stage coking. Esso Research & Engineering Co.

C34196 Polymerisation catalyst. Esso Research & Engineering Co.

P33795 Selective weed killers. Evans & Rais Ltd.

C33769 Aromatic polyesters structures dyeing process. Farbwerke Hoechst AG.

C33770 Olefines polymerisation process. Farbwerke Hoechst AG.

ACCEPTANCES

Applications in the following list, and the specifications filed in pursuance thereof, will be open to public inspection in due course. Persons interested may give notice of opposition to the grant of a Patent on any of the applications included in the list by filing Patents Form number 12 at any time within the prescribed period. See 'Official Journal (Patents)' for dates on which these applications will be open to public inspection.

766 060—766 061 Uranium alloys. Imperial Chemical Industries Ltd.

765 924 Separating plutonium. Morgan, F.

765 865 Gas-producing compositions. Imperial Chemical Industries Ltd.

766 119 Coating of surfaces by, vapour deposition. British Dielectric Research Ltd.

765 853 Substituted piperidines. Abbott Laboratories.

765 867 Microbiological oxidation or steroids. Olin Mathieson Chemical Corp.

766 151 Oxidative alkaline fusion of organic compounds. Baker Castor Oil Co.

765 868 Substituted acetonitrile compounds. Farbwerke Hoechst AG.

766 043—766 044—765 946 Luminescent materials. General Electric Co. Ltd.

766 066 Expanded synthetic resins. Fairey Aviation Co. Ltd.

766 120 Distillation of benzolized wash oil. Koppers Ges.

765 870 Margarine manufacture. [Addition to 650 481.] Unilever Ltd.

765 871 Concentrated injection preparations of steroid anti-hormones. Schering AG.

766 257 Coating of plastic material. Muirhead & Co. Ltd.

765 957 Bis (4-amino phenoxy) alkane derivatives. Wellcome Foundation Ltd.

765 849 Aminoalkyl phenyl ethers. University of Leeds

765 872 Heterocyclic compounds. Boots Pure Drug Co. Ltd.

766 008 Controlling flow of highly viscous or thixotropic liquids. North Thames Gas Board.

765 874 Chemical compounds containing the pyrrocoline nucleus and chemical compounds produced thereby. Wellcome Foundation Ltd.

766 123 Synthetic resins adhesives. British Industrial Plastics Ltd.

765 851 Preparation of tertiary amines. Armour & Co.

765 852 Preparation of tertiary methylalkylamines. Armour & Co.

766 012 Anti-tubercular compositions. Merck & Co., Inc.

765 972 Aldehyde hydrogenation. Esso Research & Engineering Co.

765 879 Analogue of pantethine- ω -methyl-pantethine. Parke, Davis & Co.

765 880 Ungelatinised tertiary amino alkyl ethers of amylaceous materials. National Starch Products, Inc.

765 792 Vinyl ethers. Rohm & Haas Co.

765 881 2-butylamines and intermediates therefor. Soc. Des Laboratoires Labaz.

765 796 Sulphur dioxide from sulphur and sulphur trioxide. Allied Chemical & Dye Corp.

765 973 Condensers. Siemens & Halske AG.

766 014 Cuperiferous disazo-dyestuffs. Ciba Ltd.

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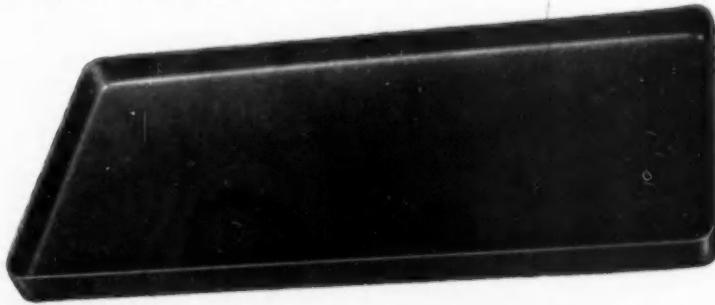
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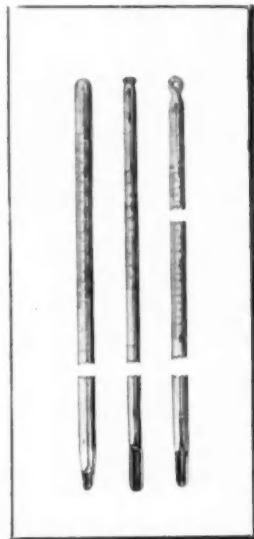
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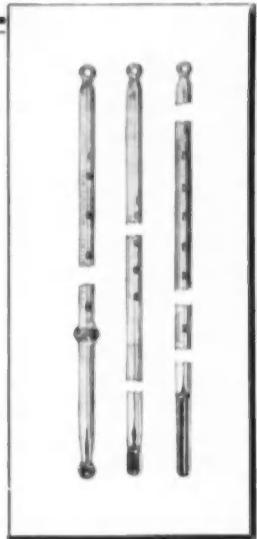
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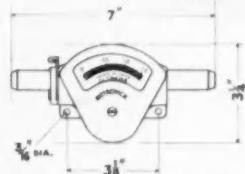
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